



# Technology Opportunity

Technology Transfer & Partnership Office

TOP3-00228

## Acoustical Testing Laboratory

### Technology

The Acoustical Testing Laboratory (ATL) provides a variety of acoustical testing services to support verification requirements and low-noise design programs for space flight hardware and commercial products.

### Background

Space flight hardware and science experiment payloads must meet stringent acoustic emission requirements. These requirements support hearing conservation, speech communication, and mission safety goals and prevent noise-induced vibrations from deteriorating the on-orbit microgravity environment. Payload acoustic emissions must be test-verified before launch, and frequent testing is a critical element in a low-noise design that allows payloads to successfully meet these requirements. The ATL at the NASA Glenn Research Center (GRC) in Cleveland provides acoustic emission testing services for the International Space Station (ISS) and other NASA projects.

### Services

The ATL is available to NASA organizations, payload contractors, and commercial clients. The ATL provides a comprehensive array of acoustical testing services, including sound pressure level measurement, sound power level determination, and sound intensity studies on test articles ranging from individual components to full rack payloads. In addition, low-noise design services are offered, which combine a progressive testing program with expert acoustical engineering to help customers meet their acoustic emissions requirements.

### Technology Description

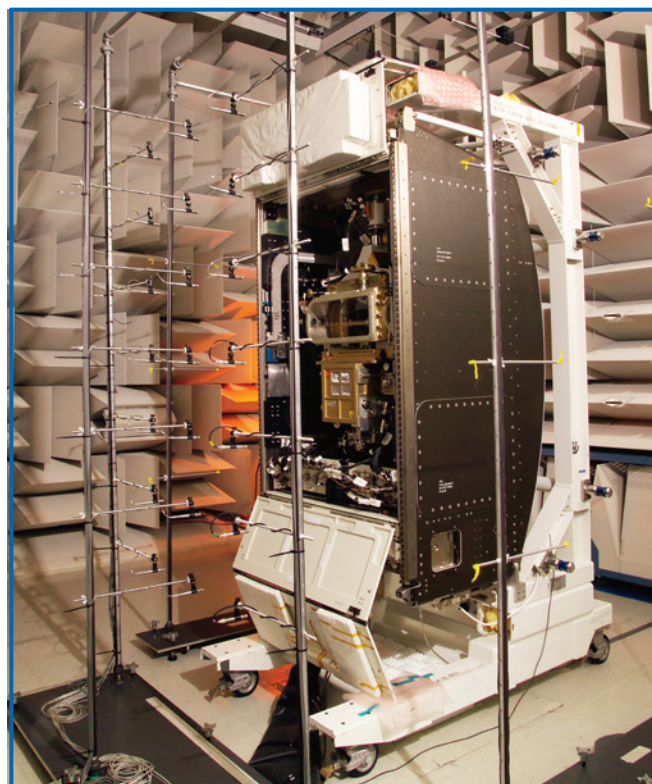
The ATL is unique among NASA facilities. It is the only anechoic test facility agencywide that is dedicated to supporting the development and qualification of space flight hardware. The anechoic test environment, data acquisition system, and signal processing capabilities of the ATL are state of the art among both government and private sector laboratories. Our engineering and consulting staff has the background and experience to assist clients with their acoustical design and testing needs.

### Accreditation

The ATL is accredited by the National Institute of Standards and Technology under the National Voluntary Laboratory Accreditation Program (NVLAP Code 200557-0) for sound power determinations in accordance with ANSI S12.54 and ISO 3744. In addition, the ATL maintains a NVLAP accredited program for the measurement of emission sound pressure levels at operator and other specified positions in accordance with ISO 11201, which the ATL utilizes to verify compliance with International Space Station noise emission requirements. The ATL is the only laboratory in the United States to be accredited for ISO 11201.

### Benefits

- The ATL offers accurate and repeatable measurements on even the smallest and quietest noise sources.



*The Fluids Integrated Rack of the International Space Station's Fluids and Combustion facility, shown during final acoustic emissions verification testing in the ATL.*

- The ATL's ISO 17025-compliant quality program ensures the professional integrity and technical competence of every ATL service.
- Acoustical engineering services assist customers with materials selection, noise budgeting, and design strategies.
- ATL customers benefit from specialized educational resources, including design guides, technical workshops, and multimedia instructional products.

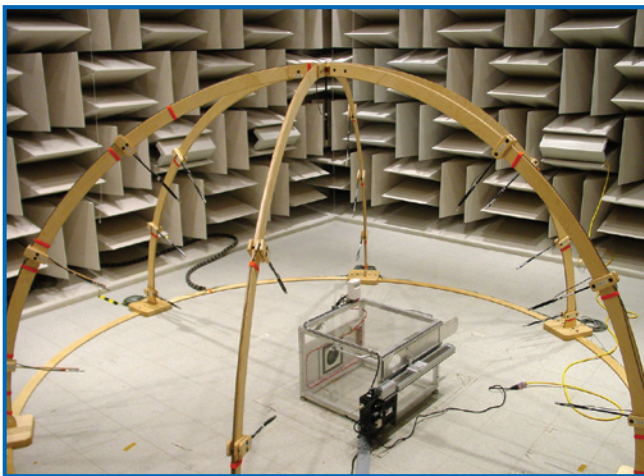
## Facility Description

The ATL consists of a fully vibration-isolated anechoic/hemianechoic test chamber with 21- by 17-foot-high interior working dimensions. A 36-inch deep fiberglass anechoic wedge treatment with a high-open-area perforated metal facing provides 99 percent normal incidence sound absorption at frequencies at and above 100 Hz. Measurements at frequencies as low as 50 Hz can be conducted with engineering-grade precision (applicable frequency ranges depend on test requirements and specifics of the item under test.)

Removable floor wedge carts allow the facility to be configured as either a hemianechoic or fully anechoic chamber. The test chamber has double doors (9- by 10 ft) for rack and equipment access. A removable ceiling plug (8- by 8 ft) provides crane access for working with large test articles. A separate, sound-isolated control room houses the data acquisition system and can double as a mechanical room for test articles with noise-emitting support equipment.

## Measurement Capabilities

The ATL's PC-based data acquisition system provides up to 26 channels of simultaneous data acquisition with real-time one-third octave band, and FFT measurements. A scanning sound intensity system provides the capability



*The ATL's 19-microphone array and fan test plenum are used to simultaneously characterize the aerodynamic performance and noise emissions of cooling fans.*

of identifying noise sources and detecting acoustic leaks as part of a low-noise design process. The ATL also offers a variety of specialized diagnostic measurements to support our clients' low-noise design efforts. Test articles may be instrumented to provide accelerometer, modal hammer, shaker, and interior microphone (for TL-type measurement) data. The ATL also has the capability of simultaneously characterizing the aerodynamic performance and noise emission of cooling fans in accordance with ISO 10302, using a fan test plenum. Custom software designed specifically for the ATL automates the test documentation, data acquisition, analysis, and reporting of results for fast and accurate transmission of data to ATL clients.

## Commercial Applications

The same low-noise design principles used by NASA to build flight hardware, of which acoustic emissions testing is a key component, result in quieter products for our commercial clients. Quieter products contribute to a safer, more productive, and more comfortable work environment. Products and equipment with low noise emissions pose less risk to the end user and are more economical because they operate more efficiently. When noise sources have been identified and reduced early in the design process, these products will require fewer costly "fixes" in the form of acoustical materials, which also consume valuable weight and space.

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## References

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## Key Words

Acoustic emissions testing  
 Anechoic chamber  
 Low-noise design  
 Acoustical Testing Laboratory  
 Sound power level  
 Hemianechoic chamber  
 Noise emission  
 Hearing conservation  
 Flight hardware requirements  
 International Space Station noise

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